

FCC TEST REPORT

Test report No.: EMC- FCC- R0174
FCC ID: UBUSLVNK6
Type of equipment: Portable magnetic card and bar-code reader for smartphone
Model Name: SLVNK-6
Applicant: ITWell Co., Ltd.
FCC Rule Part(s): FCC Part 15 Subpart C 15.225
Frequency Range: 13.533 MHz ~ 13.567 MHz
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

The results of testing in this report apply to the product/system which was tested only.

Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of receipt: 2014. 06. 30

Date of test: 2014. 07. 17 ~ 07. 23

Issued date: 2014. 07. 25

Tested by:



BAEK, DONG HUN

Approved by:



YU, SANG HOON

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1. Client information

Applicant: ITWell Co., Ltd.
Address: #505, Gayang Techno-Town, 217, Heojun-ro, Gangseo-gu, Seoul,
Korea, 157-805
Telephone number: +82-2-360-2354
Facsimile number: +82-2-360-2339
Contact person: Hyung-Jun Lim / hjlim@itwell.co.kr

Manufacturer: ITWell Co., Ltd.
Address: #505, Gayang Techno-Town, 217, Heojun-ro, Gangseo-gu, Seoul,
Korea, 157-805

2. Laboratory information

Address

EMC compliance Ltd.

65, Sinwon-ro, Yeongtong-gu, Suwon- si, Gyeonggi-do, 443-390, Korea
Telephone Number: 82-31-336-9919 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231
FCC Site Registration No.: 687132
VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849
IC Site Registration No.:8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant :	ITWell Co., Ltd.
Address of Applicant:	#505, Gayang Techno-Town, 217, Heojun-ro, Gangseo-gu, Seoul, Korea, 157-805
Manufacturer:	ITWell Co., Ltd.
Address of Manufacturer:	#505, Gayang Techno-Town, 217, Heojun-ro, Gangseo-gu, Seoul, Korea, 157-805
Type of equipment:	Portable magnetic card and bar-code reader for smartphone
Basic Model:	SLVNK-6
Serial number:	Engineering Sample

3.2 General description

Operating Frequency	13.560 MHz
Frequency Range	13.533 MHz ~ 13.567 MHz
Type of Modulation	ASK
Number of Channels	1 channel
Type of Antenna	PCB Antenna
Power supply	DC 3.7 V
Operating temperature	-10 °C ~ 50 °C

3.3 Test frequency

frequency	13.560 MHz
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4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Status
15.225 (a)	In-band Fundamental Emission	C
15.225 (b), (c)	In-band Spurious Emission	C
15.225 (d) 15.209	Out-of-band Emission	C
15.225 (e)	Frequency Stability Tolerance	C
15.207	Conducted Emissions	C
Note: C=complies NC= Not complies NT=Not tested NA=Not Applicable		

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = KU_c (K = 2)$	
Frequency stability Tolerance	$\pm 6.11 \text{ kHz}$	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.86 dB, - 4.88 dB
	300 MHz ~ 1 000 MHz:	+ 4.98 dB, - 4.99 dB

5. Test results

5.1 In-band Fundamental Emission

5.1.1 Minimum Standard

15.225 (a) The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

5.1.2 Measurement Procedure

Test Procedure The Radiated Electric Field Strength intensity has been measured on semi anechoic chamber with a ground plane and at a distance of 3 m.

Frequency : From 9 kHz to 30 MHz at distance 3m The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

Frequency : From 30 MHz to 1 GHz at distance 3m The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector. The radiated emission measurements were made with the following detector function of the test receiver (below 1 GHz).

Freq'	9 - 90 kHz	90 - 110 kHz	150 - 490 kHz	490 kHz - 30 MHz	30 MHz -1 GHz
Detector type	PK/AV	QP	PK/AV	QP	QP
IF bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz

* Part 15 Section 15.31 (f)(2) (9 kHz - 30 MHz)

[Limit at 3m]=[Limit at 300m]-40 x log(3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

5.1.3 Test Result

- Complies

EUT	Portable magnetic card and bar-code reader for smartphone		
Operating Frequency	13.560 MHz	Model Name	SLVNK-6
Operating Mode	Transmitter Mode	Modulation Technology	ASK
Environmental Condition	21 °C/46 %	Test Channel	1ch

Frequency	Reading (dB μ V)	Correction Factor	field strength dB μ V/m at 3 m
13.560 MHz	41.8	-11.6	30.2
Maximum Level(dBμV/m)			-21.3
Limit(dBμV/m) at 3m			124 dB μ V/m
margin			93.8

Note: Field strength limit was calculated with 40 dB/dec

5.2 In-band Spurious Emission

5.2.1 Regulation

15.225 (b) With in the bands 13.410 - 13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225 (c) With in the bands 13.110 - 13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

5.2.2 Test Result

- Complied

DC 3.7 V

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA							
13.374	9	40.7	V	-11.6	90.5	29.1	61.4
13.494	9	40.6	V	-11.6	80.5	29	51.5
13.569	9	39.7	V	-11.6	80.5	28.1	52.4
13.891	9	40.5	V	-11.6	90.5	28.9	61.6

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + Attenuator + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10 dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

5.3 Out-of-band Emission

5.3.1 Regulation

15.225 (d) The Field Strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in 15.209

Frequency (MHz)	Field Strength ($\mu V/m$)	Measurement distance (meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/F(kHz)	30
1.705-30.0	30(29.54 dB $\mu V/m$)	30
30.0-88.0	100(40 dB $\mu V/m$)	3
88-216	150(43.5 dB $\mu V/m$)	3
216-960	200 (46 dB $\mu V/m$)	3
Above 960	500 (53.98 dB $\mu V/m$)	3

5.3.2 Measurement Procedure

The spurious emissions from the EUT will be measured on an 10 m Anechoic chamber in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna.

The antenna was positioned 3, 10 or 30 meters horizontally from the EUT.

Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions.

In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2].

The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in dB $\mu V/m$, is arrived at by taking the reading from the EMI receiver (Level dB μV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit. The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: RBW: 200 Hz

150 kHz – 30 MHz: RBW: 9 kHz

The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.

The EUT was placed on the top of the 0.8 meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1 000 MHz using the BILOG antenna.

To obtain the final measurement data, the EUT was arranged on a turntable situated on a 10 m chamber. The EUT was tested at a distance 3 meters.

Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.3.3 Test Result

-Complied

Measurement Distance: 3 m

DC 3.7 V

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.							
0.009	9	68.7	H	-10.5	128.5	58.2	70.3
0.613	9	52.9	H	-12.4	72.7	40.5	32.2
17.04	9	42.2	H	-11.5	69.5	30.7	38.8
433.899	120	36.2	V	-7.2	46.0	29.0	17.0
474.588	120	36.4	V	-6.2	46.0	30.2	15.8
569.495	120	38.0	V	-3.8	46.0	34.2	11.8
623.739	120	40.0	V	-2.7	46.0	37.3	8.7

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + Attenuator + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10 dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.4 Frequency Stability tolerance

5.4.1 Regulation

15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4.2 Test Result

- Complied

DC 3.7 V

VOLTAGE (%)	POWER (V)	TEMP (°C)	FREQ (Hz)	FREQ.DEV (Hz)	Deviation (%)
100	3.6	20	13 559 545	455	0.003 36
		-20	13 559 473	527	0.003 89
		-10	13 559 537	463	0.003 41
		0	13 559 568	432	0.003 19
		10	13 559 603	397	0.002 93
		20	13 559 623	377	0.002 78
		25	13 559 555	445	0.003 28
		30	13 559 533	467	0.003 44
		40	13 559 537	463	0.003 41
		50	13 559 547	453	0.003 34
85	2.55	20	13 559 545	455	0.003 36
115	4.83	20	13 559 545	455	0.003 36

5.5 Conducted Emission

5.5.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

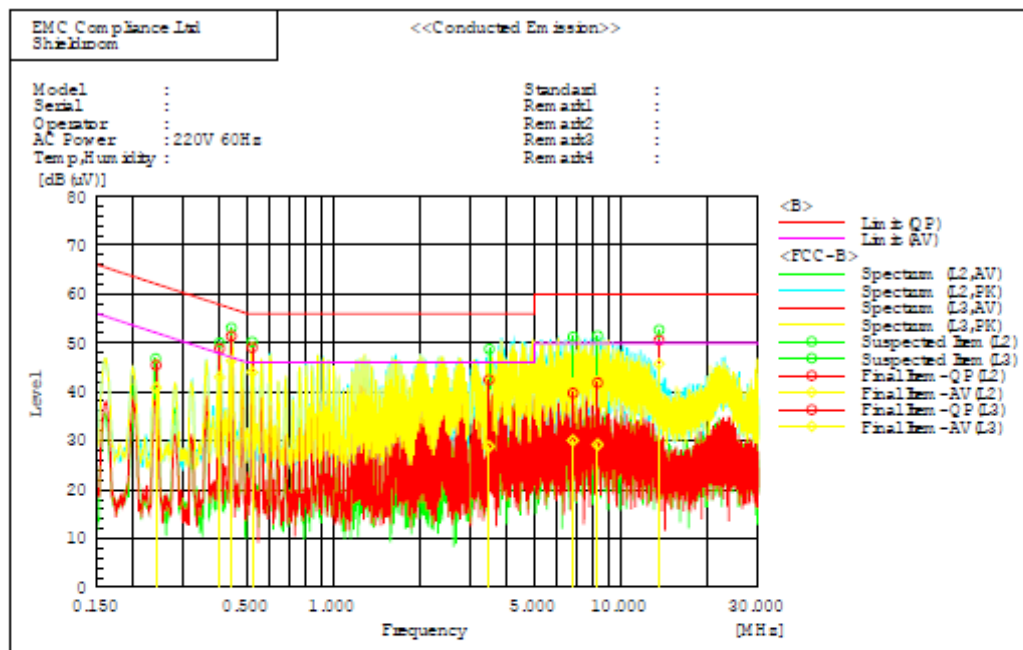
According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.5.2 Measurement Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω /50μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.5.3 Test Result

- Complied



Final Result

--- L2 Phase ---											
No.	Frequency [MHz]	Reading QP [dB (uV)]	Reading CAW [dB (uV)]	c.f. [dB]	Result QP [dB (uV)]	Result CAW [dB (uV)]	Limit QP [dB (uV)]	Limit AV [dB (uV)]	Margin QP [dB]	Margin CAW [dB]	Remark
1	3.47174	32.1	18.5	10.4	42.5	28.9	56.0	46.0	13.5	17.1	
2	6.79669	29.0	19.2	10.8	39.8	30.0	60.0	50.0	20.2	20.0	
3	8.27267	30.8	18.1	11.1	41.9	29.2	60.0	50.0	18.1	20.8	
--- L3 Phase ---											
No.	Frequency [MHz]	Reading QP [dB (uV)]	Reading CAW [dB (uV)]	c.f. [dB]	Result QP [dB (uV)]	Result CAW [dB (uV)]	Limit QP [dB (uV)]	Limit AV [dB (uV)]	Margin QP [dB]	Margin CAW [dB]	Remark
1	0.24069	35.3	30.7	10.2	45.5	40.9	62.1	52.1	16.6	11.2	
2	0.40073	38.5	32.6	10.4	48.9	43.0	57.8	47.8	8.9	4.8	
3	0.44037	41.0	35.9	10.4	51.4	46.3	57.1	47.1	5.7	0.8	
4	0.52038	38.7	33.6	10.4	49.1	44.0	56.0	46.0	6.9	2.0	
5	13.55919	38.2	33.4	12.3	50.5	45.7	60.0	50.0	9.5	4.3	

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
■	Temp & Humidity Chamber	ESPEC CORP.	SH-661	92004048	15.03.10
■	Spectrum Analyzer	R&S	FSG13	100051	15.02.05
■	Signal Ganagerator	R&S	SMR40	100007	15.06.10
■	DC Power Supply	Tektronix	PS2520G	TW50517	15.03.11
■	Amplifier	Sonoma	310N	293004	14.10.31
■	BiLog Antenna	Schwarzbeck	VULB 9168	440	15.10.16
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Test Receiver	R&S	ESCI7	100732	15.01.27
■	3 dB Attenuator	HP	8491B	22981	15.03.04
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-